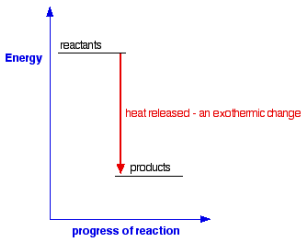
mockingbird

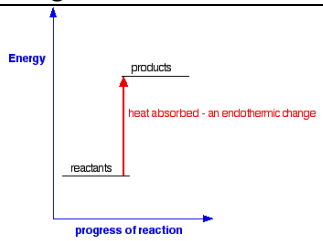
Unit 5: chemical energetics

5.1 enthalpy change

Enthalpy change: the amount of heat energy taken in or given out during any change in a system, given that pressure is constant

Exothermic	Endothermic
Gets hot	Gets cold
Heat energy is released out	Heat energy is absorbed in
ΔH is negative	ΔH is positive
Reactants have more energy than products	Products have more energy than reactants
Such as combustion and neutralization	Such as atomization and thermal decomposition
Making bonds in product side is exo and negative	Breaking bonds in reactants side is endo and positive





Standard conditions: 298K and 101 kPa and where the molecules are in their standard states

Enthalpy change of reaction: when the reactants in the stochiometric equation react to give products
Enthalpy change of formation: when one mole of a compound is being formed from its elements
Enthalpy change of combustion: when one mole of a substance is burnt in excess oxygen
Enthalpy change of neutralization: when one mole of water is formed by reacting an acid and alkali
Enthalpy change of atomization: when one mole a gaseous state of a substance is formed

Equations we have to know:

$Q = mc\Delta T$ **$\Delta H = -mc\Delta T/n$**

Where q is the amount of heat evolved or absorbed in Joules, m is he volume of solution used, c is specific heat capacity of water, n is moles of the limiting reagent, and ΔT is the temperature change in Celsius or kelvin

Measuring ΔH of combustion:

1. Add a known mass of liquid in a spirit burner
2. Add a known mass of water in a beaker
3. Burn the liquid with the beaker above it
4. Measure the temperate change of the water
5. Use q=mcΔT

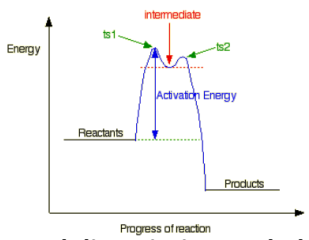
Measuring ΔH of neutralization:

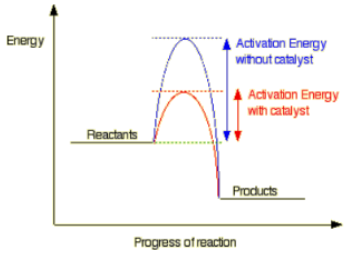
1. Record initial temperature of acid
2. Add a known volume of acid and base
3. Record the maximum temperature reached
4. Find temperature difference
5. Draw a graph

Measuring ΔH of reaction:

Enthalpy change for bonds broken + enthalpy change for bonds formed
Where bonds broken are reactants (+) and bonds formed are products (-)

Activation energy: sufficient amount of energy required for a reaction to take place, it is decreased when a catalyst is added
When a reaction forms an **intermediate**, there are two activation energies, one for the formation of each "product"





Bond dissociation enthalpy: the energy needed to break one mole of the bond to give separated atoms, being in the gaseous state
Mean bond enthalpy: the average bond dissociation enthalpy for a particular bond in a range of different compounds, it is linked to the length of the bond, the shorter the bond the higher the bond enthalpy

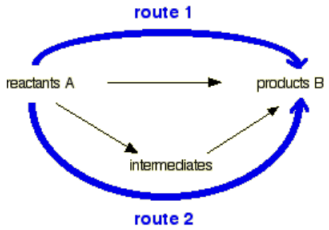
mockingbird

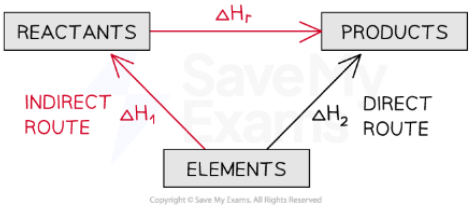
5.2 Hess' law

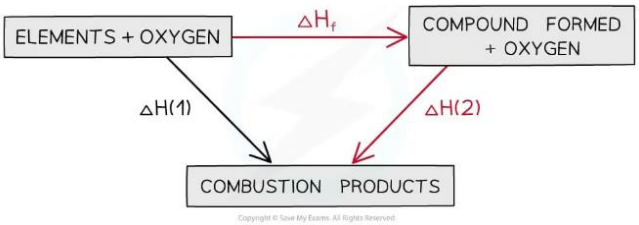
Hess' law: the overall enthalpy change for a reaction for a reaction is independent of the route it takes, this is due to the first law of thermodynamics which states that energy cannot be created or destroyed, only changed form

Tips and tricks:

Ensure correct direction of the arrows
Take note of the co-efficient, multiply that specific bond energy by the co-efficient
Don't balance the additional route
Change the sign only once when you flip
Show full working including the actual equations
Use enthalpy change of combustion when only H,O, and C are present







Extra page for pastpapers notes